FREP

REPORT #9

FOREST AND RANGE EVALUATION PROGRAM

September 2006

An Evaluation Of The Reforestation Strategies Of The Fort St. John Pilot Project

BRITISH COLUMBIA
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Resource Stewardship Monitoring

Sustainability of Forest and Range Resources Through Science and Stewardship

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Management of forest and range resources is a complex process that often involves the balancing of ecological, social, and economic considerations. This evaluation report represents one facet of this process. Based on monitoring data and analysis, the Timber resource value team offers the following recommendations to those who develop and implement forest and range management policy, plans, and practices.

Library and Archives Canada Cataloguing in Publication Data

An Evaluation of the Reforestation Strategies of the Fort St. John Pilot Project [electronic resource]

(FREP report ; #9)
Electronic monograph in PDF format.
Prepared by Allan Powelson ... [et al.].
Issued by: Forest Practices Branch.
At head of title: Forest and Range Evaluation Program.
"September 2006".
Includes bibliographical references.
ISBN 978-0-7726-6043-5

1. Reforestation--Government policy--British Columbia--Fort St. John Region. 2. Forest management--Environmental aspects--British Columbia --Fort St. John Region. 3. Forest landscape management--British Columbia --Fort St. John Region. I. Powelson, Allan II. British Columbia. Forest Practices Branch III. British Columbia. Forest and Range Evaluation Program IV. Series: FREP report (Online) ; #9.

SD409E92 2008 634.9'560971187 C2008-906024-5

Citation:
B.C. Ministry of Forests & Range. 2007. An Evaluation of the Reforestation Strategies of the Fort St. John Pilot Project , 2007. B.C. Min. For. Ran., For. Prac. Br., Victoria, B.C. FREP. <http://www.for.gov.bc.ca/hfp/frep/publications/index.htm>

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Copies of this report may be obtained, depending on supply, from:
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List of Acronyms

FPB	Forest Practices Board
FREP	Forest and Range Evaluation Program
IMS	FREP Information Management System
QMT	FREP Quality Management Team
MAL	Ministry of Agriculture and Land
MOE	Ministry of Environment
MOFR	Ministry of Forests and Range
MTSA	Ministry of Tourism, Sport and the Arts
NQI	National Quality Institute
PEP	Progressive Excellence Program

Executive Summary

Project Overview

The Forest and Range Evaluation Program (FREP) has been put in place as a multi-agency program to evaluate whether practices under the Forest and Range Practices Act (FRPA) are meeting not only the intent of current FRPA objectives, but also the government's broader intent for the sustainable use of resources.

In this light, the reforestation strategies being employed in the Fort St. John Pilot Project (FSJPP) were reviewed. This pilot project has instituted some alternative ways of meeting the reforestation obligations enacted under FRPA.

To determine if its goals are being met, FSJPP Sustainable Forest Management Plan (SFMP) outlines several indicators. The focus of this Forest and Range Evaluation Program report is on three FSJPP SFMP indictors:

(1) the diversity and pattern of communities and ecosystems,

(2) landscape-level reforestation, and

(3) establishment delay.

To get an overall indication if the indicators of reforestation as outlined in the FSJPP SFMP sections 6.28, 6.29, and 6.30 are achieving the stated objectives the information within the FSJPP Annual Report and Ministry of Forests and Range (MFR) data bases (RESULTS and FTA) were analyzed and compared.

Based upon this review, the following alterations to the FSJPP SFMP should be considered. Future SFMPs that follow this approach undertaken should:

Diversity and Pattern of Communities and Ecosystems

- Use an off-set consistent with biological regeneration delay when comparing planting composition to harvest composition to better reflect the species mix harvested and that reforested.

Landscape-level Reforestation

- Report openings included in each landscape stratum.
- To aid in the assessment of the achievement of the landscape objective, reconfigure the PMV and TMV tables of the FSJPP annual report to ensure that a complete assessment of the data presented can be accomplished.
- Restrict combining for declaration of multi-block landscape to strata of similar leading species composition.

Establishment Delay

- For ease of review and monitoring, report or record the average biological regeneration delay for the blocks meeting their regeneration requirements in the reporting year.
- Since the base information is already reported in the annual report, summarize the biological regeneration delay in a simple manner to greatly assist reviewers of the annual report.

Future analyses of the FSJPP should examine the impacts on predicted volume and on the diversity and pattern of communities and ecosystems. These future analyses should also assess the field conditions of the sites being declared in each stratum and determine the total inventory condition of these strata.

Acknowledgements

We gratefully acknowledge the following individuals for their review comments, suggestions for improvements, or assistance with the project: Allan Powelson, Pat Martin, Winn Hays-Byl, Elizabeth Hunt, Jacek Bankowski, and Anna Monetta. Review comments from various industry and government personnel were received and incorporated where possible.

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1.0 Background

The Forest and Range Evaluation Program (FREP) has been put in place as a multi-agency program to evaluate whether practices under the Forest and Range Practices Act (FRPA) are meeting not only the intent of current FRPA objectives, but also the government's broader intent for the sustainable use of resources.

In this light, the reforestation strategies being employed in the Fort St. John Pilot Program were reviewed. This pilot program has instituted some alternative ways of meeting the reforestation obligations enacted under FRPA.

The Fort St John Pilot Project Regulation (FSJPPR) allows the sustainable forest management plan to contain a landscape-level strategy for reforestation. In response to this, the Fort St. John Pilot Project Sustainable Forest Management Plan (FSJPP SFMP) strategy has the following key features:

- set standards for reforestation to restock harvested areas;
- provide a landscape-level assessment of reforestation success based on comparative measures of future volume;
- ensure that professional foresters have professional accountability at the cutblock level to vary regimes and provide for other values as they progress to a landscape-level target for volume; and
- allow continuous improvement by providing feedback on the landscape-level reforestation success. Silviculture regimes and/or corrective action can be considered across the landscape and implemented cost effectively for all values being managed.

Traditionally, reforestation success has not been measured at a landscape level. The strategies and reforestation standards outlined in the FSJPP SFMP extend beyond previous practices and add measures to assure adequate management and conservation. The reforestation strategy in this plan applies to areas harvested after November 15, 2001, under the FSJPPR. Participants may elect, in writing to the District Manager, to include areas harvested under prescription between 1987 and November 15, 2001.

As per the FSJPP SFMP, participants must declare to reforest the cutblock as a coniferous area, a deciduous area, or a mixedwood area in the Forest Development Plan or Forest Operation Schedule and initial Site Level Plan (SLP). The FSJPP SMFP outlines stocking standards for both coniferous and deciduous stands. The declaration as to which land class the block falls into may be revised before the end of the reforestation period, subject to compensating revision elsewhere on the landscape.

To determine if its goals are being met, FSJPP SFMP outlines several indicators. The focus of this Forest and Range Evaluation Program report will be on three FSJPP SFMP indictors:

1) the diversity and pattern of communities and ecosystems.
2) landscape-level reforestation, and
3) establishment delay.

1.1 *Diversity and Pattern of Communities and Ecosystems*

As part of the landscape-level reforestation strategy, the diversity and pattern of communities and ecosystems including their function, composition, and structure, will be maintained within the natural range of variability. The species composition indicator, which monitors the relative change in plantation composition compared with the species composition of the stands that were harvested, partially deals with this. The species composition indicator indicates the extent of change of species composition as a result of forest management activities on coniferous licenses.

The target statement for the diversity and pattern of communities and ecosystems indicator is the relative proportion of spruce and pine planted annually will equal the proportions harvested annually (excluding fill-planting).

1.2 *Landscape-Level Reforestation*

Under authority of the FSJPPR, block-level reforestation requirements are replaced with landscape-level reforestation requirements in the FSJPP SFMP. The landscape-level reforestation assessment system measures reforestation performance and determines if reforestation obligations are complete.

The key components of the assessment system are as follows:

- The assessment will measure success with a comparative estimate of predicted yield (predicted volume) to actual yield (target volume).
- The system will be based on data from individual cutblocks but the data will be assessed over many cutblocks across the landscape.
- Areas are evaluated at a predetermined age following harvest.
- The results are tracked at landscape and cutblock levels.

- Foresters will have flexibility at the cutblock level to vary regimes and provide for other values as they progress to a landscape-level target for yield.
- Over time, the system will provide data to improve silviculture regimes and targets.

The target statement for the landscape-level reforestation indicator is

"For coniferous areas; merchantable volume will meet or exceed target volume (95% of predicted maximum volume) within the reforestation period."

1.3 *Establishment Delay*

Another component of the reforestation requirements of the FSJPPR is establishment delay, which is used to determine if forest practices are consistent with the landscape-level strategies for coniferous and deciduous areas logged after November 15, 2001.

Establishment delay in the FSJPP SFMP is defined as the period from the start of harvest on the area to be reforested to the completion of initial establishment of future tree species as required in the SLP.

The target statement for the establishment delay indicator is

"The area weighted average establishment delay for coniferous regeneration will not exceed 2 years. The area weighted average establishment delay for deciduous regeneration will not exceed 3 years."

2.0 METHODS

To get an overall indication if the indicators of reforestation as outlined in the FSJPP SFMP sections 6.28, 6.29, and 6.30 are achieving the stated objectives, the following methods were used.

1. The FSJPP SFMP 2004/05 regulatory annual report and tables (including modifications) were reviewed and re-analyzed.
2. RESULTS queries for available biological regeneration reports were generated.
3. Custom RESULTS reports outputting harvest date and planting date were generated.
   a. Blocks were filtered by TSA (Fort St. John TSA)
   b. Blocks were then filtered by Activity Harvest start date (post-Nov. 15, 2001)
   c. Harvest date was compared to regeneration declaration date and biological regeneration delay.
4. Amount of Pli and Sw planted (excluding fill-planting) each year (since Nov. 15, 2001) was calculated using the FSJPP SFMP 2004/05 regulatory annual report data. The proportion of Pli and Sw scaled volume was determined in a similar manner and compared with the amount planted.

A potential problem with these methods is ensuring that all applicable information is up-to-date within RESULTS.

3.0 Results and Discussion

3.1 *Diversity and Pattern of Communities and Ecosystems*

Species composition indicator
FSJPP SFMP Section 6.28

According to the information presented in the 2004/05 FSJPP SFMP regulatory annual report, the percentage composition of spruce and pine planted has been fairly consistent with the percentage composition scaled of these two species (Figure 1). The exception, as noted in the annual report, is 2004 when there was a shift to greater percentage of spruce harvest. This change was not reflected in the planting of spruce, due to differences in seedling sowing, planting, and stand harvest dates.

Does comparing species planted to species harvested in a given year adequately measure indicators in section 6.28, as outlined in the FSJPP SFMP? Since seedlings are ordered 1–2 years before planting there will always be a potential delay in adjusting to changes in harvest patterns. Accounting for this delay highlights a potential problem with this method of reporting: the species composition of the planting in a given year may not reflect the species composition of the harvested landbase. As well, if on average it takes 2 years to plant an area after harvest (as indicated in the 2004/05 regulatory annual report), the trees planted in a given year are not going onto the same landbase from which the scaled harvest of that year were taken. To accurately compare the species composition being replaced with that which was harvested, off-setting the planting to scaled percentages based on average regeneration delay may better indicate if the relative proportion of species planted annually equals the proportions harvested (Figure 2).

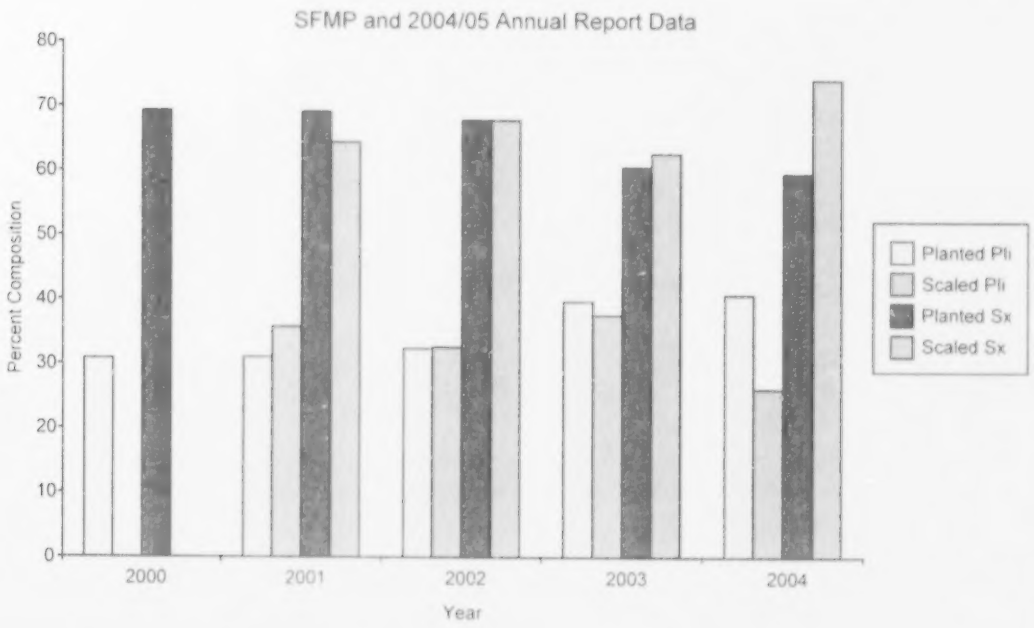

Figure 1. Species composition of planting and harvest as indicated by scaled volume.

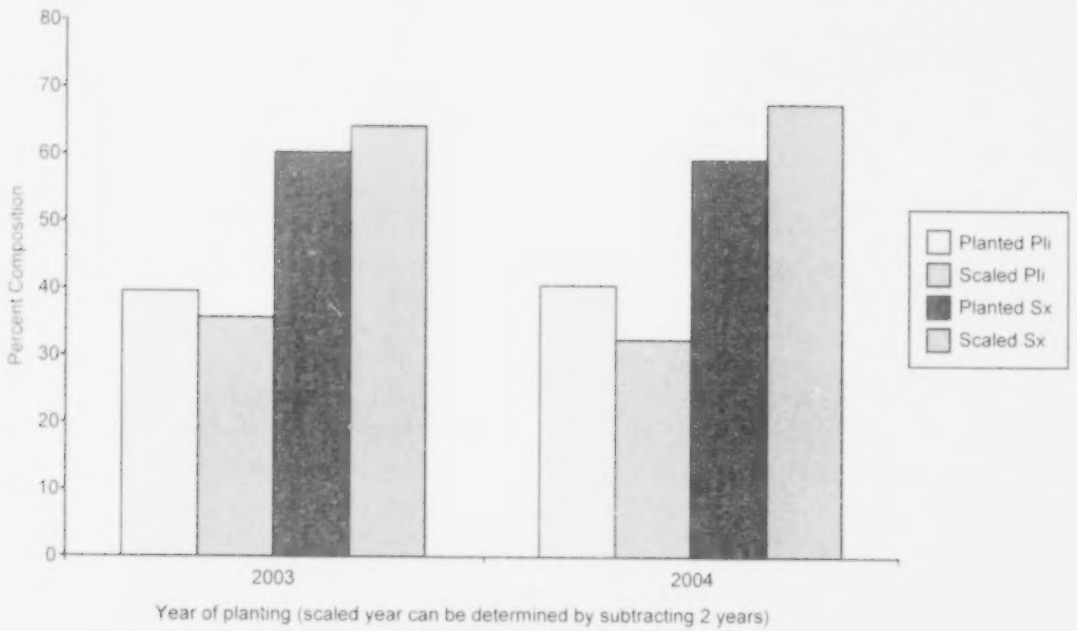

Figure 2. Off-set percent composition of planted to percent composition scaled

In Figure 2, the percent composition of seedlings that were planted in 2003 and 2004 are compared with the percent composition of volume that was scaled in 2001 and 2002. When viewed in this manner, a slight increase in the percentage of pine planted in these 2 years is revealed (3.9 and 8.1%, respectively).

Other off-set methods of directly comparing species planted to species harvested for a specific landbase are possible, such as tying planting records to harvest scale volumes by cutting permit. The intent, however, of the FSJPP was to manage species on a landscape basis; looking at species replacement block by block may not meet that objective.

Viewing and presenting the information in a manner that ties the species composition harvested to species composition planted on a specific landscape-scale landbase more closely demonstrates the achievement of the requirements of FSJPP SFMP section 6.28. Also, using the regeneration delay based off-set comparison could dramatically reduce fluctuations in scaled-to-planted proportions that can occur as indicated in the FSJPP SFMP annual report and Figure 1, when harvest focus quickly switches to reflect market trends.

3.2 *Landscape-Level Reforestation*

Reforestation assessment indicator FSJPP SFMP Section 6.29

Under the multi-block reforestation approach:

1. reforestation standards are set for groups of blocks;
2. each individual block is managed with full recognition that it is part of a larger population of harvested areas; and
3. the assessment of reforestation achievement is based on the total performance of the multi-block harvested area.

Within this system the obligation holder is held to a minimum aggregate production on the declared landbase as a whole and not held to a minimum on each and every hectare.

Under this approach, the silviculture manager is free to intensify reforestation efforts on those hectares that provide the most cost-effective gains while achieving a minimum stocking level on each cutblock. Also it is assumed that small areas of the landbase, where longer regeneration periods were the ecological norm, can be allowed to restock more slowly, thereby enhancing environmental values. The anticipated result is that the public interest will be protected by setting a high target for overall, cumulative performance.

Section 6.29 of the FSJPP SFMP states that a landscape-level reforestation approach will be used on coniferous areas within the FSJPP area. Attempting to determine what openings or landbase the information in the predicted to target volume tables in the FSJPP SFMP 2004/05 annual report is problematic. The tables (i.e., FSJPP SFMP Regulatory Annual Report 2004/05 Tables 14, 15, and 16) listing predicted volume are not clearly tied to a particular opening. Comparing the number of openings that have reported MSQ values by opening number (i.e., FSJPP SFMP Annual Report 2004/05 Tables 11 and 12) shows the same number of openings reported. However, comparing these two tables with information in RESULTS does not shed any light on which opening is represented by each inventory species class; minimum mean stocked quadrant (MSQ) values do not match, areas do not match. The ability to assess the effectiveness of this approach to reforestation is then compromised, as one cannot readily determine the landbase it applies to. As a result, this method of landscape reforestation cannot be compared to what may have been achieved using conventional approaches to reforestation.

A simple modification to the FSJPP annual reports listing the openings and the corresponding stratum that they fall into would aid in assessment of this indicator.

Indicator section 6.29 states that merchantable volume will meet or exceed target volume (with an allowable variance of 5%) within the reforestation period. When examining the data in the FSJPP SFMP 2004/05 regulatory annual report, we can see that different methods of interpretation can have different outcomes. For example, one participant reported that they achieved 98.4% of the target volume. This value represents a pooling of Pl-leading sites (SI 17–25) with Sx-leading sites (SI 15–29). When the achievement of target volume is separated into Pl-leading sites and Sx-leading sites alone, we see that, when weighted for area, this participant achieved 101.5% of the target volume on the Pl-leading sites but only 95.9% of the target volume on the Sx-leading sites (Table 1). Both are within the allowable variance levels. However, when examined for impacts on species groupings alone and not weighted by area, this participant achieved on average 100% of the target volume on the Pl-leading sites but only 87.6% of the target volume on the Sx-leading sites. As a portion of area, 26.7% of the Sx-leading area was below 95% of the target volume and outside of the acceptable variance. When viewed this way, the impacts on particular species groupings and particular strata can be assessed. By viewing the results in various manners, one can see the full impact on the landscape. The impacts on smaller ecosystems or ecosystems that are not as widely represented on the landbase can be lost or may not be evident when only a weighted average result is presented

While the two indicators should be kept separate, to be consistent with the objectives outlined in section 6.28 for diversity and patterns of communities and ecosystems that, when combining populations for the declaration of multi-block landscapes, the strata should be restricted to those with similar leading-species composition. For example, pine-leading strata should be assessed separately from spruce-leading strata. In this way, the impacts on the diversity and patterns of communities and ecosystems can be assessed at the same time as the impacts on future volume production. By presenting the information in a manner that allows for full examination of the impacts of this strategy, it is possible to determine the impacts on smaller ecosystems.

Also, indicator section 6.29 has a commitment to achieve a MSQ value of 2 on sites with a target stocking standard (TSS) of 1200 or above, a MSQ value of 1.7 on sites with a TSS of 1000, and a MSQ of 1.3 on sites with a TSS of 800. In the FSJPP, the minimum MSQ value is assessed at the cutblock level, not at the stratum level. The inclusion of the MSQ column on the stratum level allows for the assessment of the MSQ values achieved by the separate strata that may be lost when the MSQ is only viewed at a cutblock level.

To better assess the achievement of the landscape objective, the PMV and TMV tables of the FSJPP annual report should be reconfigured to ensure that a complete assessment of the data can be presented

Table 1. Modified predicted merchantable volume (PMV) and target merchantable volume (TMV) tables. (Red values indicate values below standard; green values indicate modifications from the original presented in the regulatory annual report.)

Stratum	Net Area (ha)	Mean SI	Mean EA	Mean MSQ	Mean TSS	PMV/ha	Total PMV	Target MSQ	Target EA	TMV/ha	Total TMV
Pl/SR/19-21/1200-1400	20.1	19.4	11.8	2.6	1200	397.5	7989	3.7	14	440.5	8855
Pl/WG/17-19/1200-1400	44.3	18.2	12.3	3.6	1200	399.1	17680	3.7	14	385.2	17063
Pl/WG/19-21/1200-1400	212.8	18.8	12.4	3.4	1200	420.1	89405	3.7	14	410.5	87355
Pl/WG/21-23/1200-1400	210.9	20.8	12.3	3.5	1200	519.8	109633	3.7	14	507.1	106958
Pl/WG/23-25/1200-1400	49.3	22.6	12.1	3.5	1200	609.3	30038	3.7	14	592.5	29212
PlSx/SR/17-19/1200-1400	36	16.5	12.4	2.5	1200	283.9	10221	3.7	14	316.8	11405
PlSx/SR/19-21/1200-1400	11.3	19.3	13.9	2.6	1200	422.2	4771	3.7	14	456.3	5156
PlSx/WG/17-19/1200-1400	45.5	16.8	12.5	3.9	1200	349.9	15920	3.7	14	334.5	15220
PlSx/WG/19-21/1200-1400	254.4	19.1	13.1	3.3	1200	452.7	115165	3.7	14	445.5	113337
PlSx/WG/21-23/1000-1200	7.9	21.1	13.2	3.3	1000	554.1	4377	3.5	14	538.5	4254
PlSx/WG/21-23/1200-1400	268.3	22.2	13.9	3.2	1200	605.3	162411	3.7	14	597.3	160251
PlSx/WG/23-25/1200-1400	73	23.5	14.7	3.2	1200	678.5	49527	3.7	14	665.1	48550
PlSx/WG/25-27/1200-1400	18	24	16.7	3.2	1200	713.3	12840	3.7	14	688.6	12396
	35.5	18.7	10.5		1200	239.4	8356	3.7	14	456.5	16207
Sx/SR/15-17/1200-1400	9.8	16.8	19.8		1200	288.9	2831	3.7	14	352.6	3455
Sx/SR/17-19/1200-1400	27.8	13.8	12.2		1200	149.4	4152	3.7	14	199	5533
Sx/SR/19-21/1200-1400	95.8	21.5	15.2	2.1	1200	504.7	48351	3.7	14	602.3	57699
Sx/SR/21-23/1000-1200	4.6	23.1	14.3	1.8	1000	521.5	2399	3.5	14	676.8	3114
Sx/SR/21-23/1200-1400	181.5	23.3	15.4	2.3	1200	615.5	111709	3.7	14	693.7	125907
Sx/SR/25-27/1200-1400	23	26.2	14.2	2.4	1200	753	17320	3.7	14	847.3	19487
Sx/SR/27-29/1200-1400	25.2	28.7	12.3		1200	706	17791	3.7	14	975.8	24590
Sx/WG/17-19/1200-1400	39	19.5	10.6	2.9	1200	494.4	19281	3.7	14	496.8	19374
Sx/WG/19-21/1200-1400	116.8	21.8	15.2	3.1	1200	623.5	72824	3.7	14	615.3	71873
Sx/WG/21-23/1200-1400	235.1	23.8	14.6	3.1	1200	728.2	171202	3.7	14	718.8	168984
Sx/WG/23-25/1200-1400	695.3	24.6	15.4	3	1200	769.8	535274	3.7	14	764.2	531363
Sx/WG/25-27/1200-1400	17.8	27.1	15.7	3.1	1200	905.7	16122	3.7	14	892.7	15890
Sx/WG/25-27/1400-1600	2.2	26.5	10.8	3.7	1400	882.9	1942	3.9	14	863.4	1899
	2761.2			2.8			1659529	3.7			1685387

Numbers in red are values below minimum requirement

3.3 *Establishment Delay*

Establishment delay indicator FSJPP SFMP Section 6.30

Establishment delay in the FSJPP SFMP is the period from the start of harvest on the area to be reforested to the completion of initial establishment of future tree species as required in the SLP. A close reading of this indicator is that the establishment delay is not calculated by determining how long it takes to reforest a site, but how old the areas without an established plantation are. It is also known as the age of the "un-established" stands. There is some concern that this method of reporting may skew the period it takes to reforest to a lower point as it is heavily weighted with recently harvested sites, pulling the average period to reforest down.

The period between the harvest of trees and the re-occupation of the site with seedlings can be described in several ways. In addition to establishment delay as described in the FSJPP SFMP, there is regeneration delay (RD), which is the maximum time allowed in a prescription, between the start of harvesting on the area to which the prescription applies, and the earliest date by which the prescription requires a minimum number of acceptable well-spaced trees per hectare to be growing on that area. This is usually determined as the amount of time between start of harvest on a site until a survey is completed and the site is declared restocked. Another method is the biological regeneration delay (BRD), which is the amount of time between the start of harvest and time when seedlings are established on site, either through natural or artificial means. BRD can also be looked at in two ways: look forward and determine the amount of time from harvest until a new crop of trees is established, or look backwards at the time of establishment of the new crop how many years back was the start of harvest.

The FSJPP SFMP 2004/05 regulatory annual report indicates that the establishment delay for the reporting period was 1.2 for BC Timber Supply (BCTS) and 1.0 for all others. Again this represents the average age of areas without an established plantation ("age of un-established sites"). Thus, for all areas that don't have an established plantation, the 1.2 value, for example, indicates the number of years on average that they have been in this state. This value does not give us an indication of how long it took to go from harvest to plantation establishment, also known as biological regeneration delay.

A graphic comparison of the two types of BRD, RD, and the establishment delay indicated by the licensees in the FSJPP (Figure 3) shows that the choice of description of the period of how long a site is not occupied by desired crop trees can dramatically affect the interpretation.

The regeneration delay and biological regeneration delay are for the most part dramatically larger than the establishment delay reported by either Canfor or BCTS.

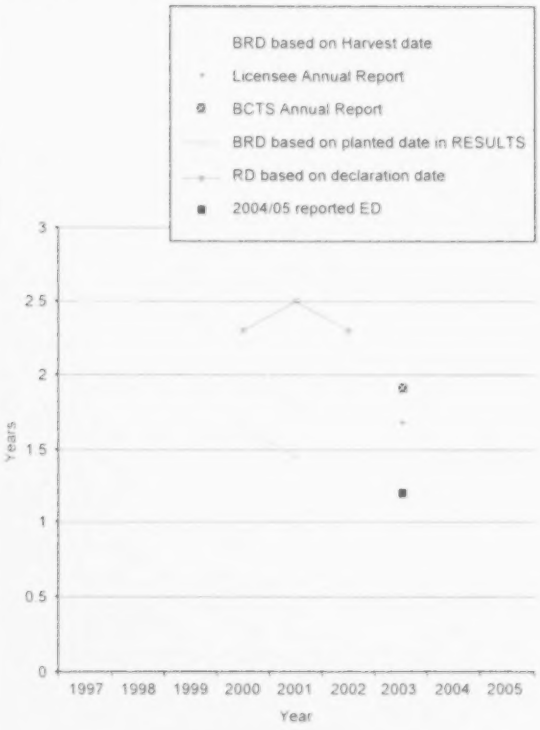

Figure 3. Establishment delay (ED), regeneration delay (RD), and biological regeneration delay (BRD) as indicated in RESULTS information.

While this trend in BRD seems to indicate an increase in the regeneration delay, problems with this interpretation do arise. First, the time of establishment in the BRD report is indicated by the date at which the status changed in RESULTS from NSR to IMM. This date would then include all delays in reporting and not truly indicate the time between harvesting and planting. The ability to analyze this trend is compromised as there is no clear way of determining the true time between harvest and planting using "canned" reports within RESULTS. Customized RESULTS reporting for the years 2000 to 2005 that subtracted the harvest date from the planted date indicated that, for blocks harvested in the

years 2000 and 2001, the BRD was 1.65 years and 1.45 years, respectively, for planted sites. Dates past this point were not included in this analysis as the average BRD calculated for those years did not include blocks harvested in those years that were not yet planted possibly, skewing the BRD earlier. This method does not include those sites that were reforested through natural regeneration, so present an incomplete picture

The determination of establishment delay as calculated by the signatories of the FSJPP SFMP is not possible given the information in the annual reports or with information present within RESULTS. This lack of readily available information or information that is easily determined makes monitoring of compliance with this value extremely difficult. In the 2004/05 FSJPP SFMP regulatory annual report, the tables that are intended to indicate the establishment delay consisted of lists of harvest year and year of regeneration met, but these did not summarize the information to indicate the actual establishment delay period. Re-analyzing these data by subtracting the year of harvest from the year of regeneration met found that for BCTS, the reported BRD for blocks declared in 2004 was 1.9 years and for Canfor it was 1.6 years.

While there is no indication of the need to alter the establishment delay indicator, for ease of review and monitoring, the average BRD for the blocks meeting their regeneration requirements in the reporting year should be reported or recorded. The information already contained within the annual report can be used with the addition of a column indicating the BRD and then summarizing this at the end. While the FSJPP does not have a regeneration delay date requirement, the method of reporting BRD based on year of regeneration declaration appears to better indicate the time it took to establish the block compared with basing the BRD on year of harvest. Regeneration delay based on year of the requirement was met (regeneration declaration) better covers the range of time that it took to get to that state for each opening.

Due to a lack of readily available data, an assessment of "establishment delay" as used in the FSJPP is not possible. Without knowing the information behind the determination of establishment delay, we cannot comment on how this method meets societal requirements for management of the forest resource compared with other methods currently used in British Columbia.

4.0 Recommendations

Based upon this review, the following alterations to the FSJPP SFMP should be considered. Future SFMPs that follow this approach undertaken:

1. *Diversity and Pattern of Communities and Ecosystems*

- Use an off-set consistent with biological regeneration delay when comparing planting composition to harvest composition to better reflect the species mix harvested and that reforested.

2. *Landscape-Level Reforestation*

- Report openings included in each landscape stratum.
- To aid in the assessment of the achievement of the landscape objective, reconfigure the PMV and TMV tables of the FSJPP annual report to ensure that a complete assessment of the data presented can be accomplished.
- Restrict combining for declaration of multi-block landscape to strata of similar leading species composition.

3. *Establishment Delay*

- For ease of review and monitoring, report or record the average biological regeneration delay for the blocks meeting their regeneration requirements in the reporting year.
- Since the base information is already reported in the annual report, summarize the biological regeneration delay in a simple manner to greatly assist reviewers of the annual report.

5.0 Future FREP Assessments

After completion of this initial evaluation of the FSJPP reforestation strategies, the impacts of the landscape-level reforestation strategy should be further pursued. The future analyses should examine the impacts on predicted volume and on the diversity and pattern of communities and ecosystems. This process should also assess the field conditions of the sites being declared in each stratum and determine the total inventory condition of these strata.

6.0 REFERENCES

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